

2006

Location of injury site in chronic low back pain patients: an electromyographic and mechanomyographic analysis

Mark Gorelick
University of Wollongong

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Gorelick, Mark, Location of injury site in chronic low back pain patients: an electromyographic and mechanomyographic analysis, PhD thesis, Department of Biomedical Science, University of Wollongong, 2006. <http://ro.uow.edu.au/theses/541>

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**Location of Injury Site in Chronic Low Back Pain
Patients: An Electromyographic and
Mechanomyographic Analysis**

A thesis submitted in fulfilment of the requirements for the award
of the degree

Doctor of Philosophy

From

University of Wollongong

By

Mark Gorelick, MSc

Acknowledgments

Firstly, I would like to thank my primary supervisors Mark Brown and Herb Groeller. You have provided me with an amazing PhD experience both academically and socially. Mark, your never ending positive attitude and motivation was a leading factor in me finishing my thesis. Thank you! Herb, your patience and support is a rare commodity and one which I hope was instilled in me during my time in Wollongong. I hope that we continue to be colleagues and more importantly friends as time goes on.

I would like to thank Mario Solitro, who without his amazing technical capabilities I would have not been able to complete any of the testing described in this thesis. Also I would like to thank Guy Bashford for his commitment in finding chronic low back pain patients for this thesis and suggestions on study design. In addition, I would like to thank those people, too numerous to name specifically, who aided me in data collection and subject recruitment.


Importantly I would like to thank the many friends I made during my time in Wollongong, many of which I still keep in close contact with. We had a lot of laughs and I expect more to come!

Last but certainly not least, I need to give a huge thank you to my wife Bevin. She is a saint to have tolerated my stress filled moods and frequent panic attacks. I can not explain how much your immense support and love helped me along the way.

Declaration

CERTIFICATION

I, Mark Gorelick, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Department of Biomedical Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

A handwritten signature in black ink, reading "Mark Gorelick". The signature is written in a cursive style with a large, stylized 'M' and 'G'.

Mark Gorelick

06 April 2006

Abstract

The primary aim of this thesis was to determine if anatomical injury site in chronic low back (CLBP) patients can be identified by two complementary non-invasive diagnostic techniques, surface electromyography (sEMG) and mechanomyography (MMG). The application of these techniques to injury site identification is based upon the hypothesis that muscle tissues surrounding an injured joint are physiologically distinct from those surrounding “healthy” joints. Such changes in muscle physiology, associated with underlying joint pathology, may include alterations in muscle fibre type composition and number with a corresponding change in the muscle’s speed of contraction and its pattern of neuromotor control. These injury-induced changes in muscle function should be readily detected, at least in superficial muscles, by simple kinesiological techniques such as sEMG and/or MMG. Six experimental studies were conducted to validate the diagnostic tools (sEMG and MMG) and to locate injury site in a total of 73 normal and CLBP subjects and a group of 12 Wistar rats. The results of these studies validated the combined sEMG and MMG techniques and concluded that injury site in diagnosed CLBP patients could be accurately identified to within one vertebral segment of the injured zygapophyseal joint through application of the MMG technique. Importantly, the MMG technique appeared to be more sensitive than the sEMG technique to identify the injury site in CLBP patients. Although the sEMG technique could significantly ($p < 0.05$) differentiate between the CLBP and healthy control groups, it was unable to detect specific changes in muscle contractile properties associated with underlying joint pathology.

List of Publications

Peer Reviewed Publications

Gorelick M, Brown JM, Groeller H. (2003). Short-duration fatigue alters neuromuscular coordination of trunk musculature: implications for injury. *Applied Ergonomics*. 34 (4): 317-325.

Conference Presentations

Gorelick M, Brown JM, Groeller. (2005). *Whole muscle activation indicates eccentric muscle fatigue and damage*. The 2nd International Conference on Movement Dysfunction, Endinburgh.

Brown JM & Gorelick M, (2003). *Muscles within Muscles*, NSW Conference of Science and Medicine in Sport, Sydney, Australia.

Gorelick M, Brown JM, Groeller H et al. (2002). *Musculoskeletal indicators of injury site in chronic low back pain: control data*. Australia Conference of Science and Medicine in Sport: Sports and Medicine at the Extremes, Melbourne, Australia.

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